FINAL REPORT FOR
KINGS BAY, GEORGIA
103 EVALUATION OF DREDGED MATERIAL
FOR OCEAN DISPOSAL

DELIVERY ORDER 0073
CONTRACT DACW17-97-D-0001

SUBMITTED TO:

U.S. Department of the Army
Corps of Engineers, Jacksonville District
P.O. Box 4970
Jacksonville, Florida 32232-0019

SUBMITTED BY:

PPB Environmental Laboratories, Inc.
6821 S.W. Archer Road
Gainesville, Florida 32608

JANUARY 2002

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Executive Summary

EXECUTIVE SUMMARY

During the period July 18-20, 2001, eleven sample substations in Kings Bay, Georgia, were sampled as part of the Kings Bay 2001 Evaluation of Dredged Material for Ocean Disposal. This evaluation considered potential dredged material from maintenance dredging.

Sediment samples from each substation were composited to derive one representative sample per sampling station (i.e., samples E-KB01-1A, E-KB01-1B, E-KB01-1C were composited to become sample E-KB01-1).

Aluminum and iron were present in the sediments at much higher concentrations than other heavy metals. Mercury and silver were not detected in any of the sediments.

Arsenic, cadmium, chromium, copper, lead, nickel, and zinc were present at low to moderate levels.

Significant amounts of total organic carbon and ammonia were present in all sediments.

No cyanide, pesticides, PCBs, oil & grease, organotin, or polynuclear aromatic hydrocarbon compounds (PAHs) were detected in any of the sediments.

Chemical testing of elutriates showed no detectable metals except for arsenic, which was detected in samples from two stations (59.8 μg/L at E-KB01-3 and 79.7 μg/L at E-KB01-2). Chemical testing of elutriates also showed no detectable cyanide, pesticides, PCBs, or PAHs. Modest amounts of total organic carbon and ammonia were found in the elutriates, but this was not unexpected considering the concentrations present in the sediments.

Low levels of tributyltin (below 0.08 parts per billion) were detected in two elutriates.

Moderate levels of dibutyltin (below 0.44 parts per billion) were detected in two elutriates.

The elutriate test results indicated that after 96 hours of exposure to elutriates from the Kings Bay area, there were no significant differences in the survivorship of *Mysidopsis bahia* and *Menidia beryllina* between the control water (0% elutriate) or the control sediment (100% elutriate) and survival in any of the Kings Bay samples. Fertilization of *Lytechinus variegatus* gametes was not statistically different (P=0.05) for the control water (0% elutriate) or the control sediment (100% elutriate) and survival in any of the Kings Bay samples from fertilization for any of the Kings Bay stations.

The sediment test results indicated that after 10 days of exposure to sediments from the Kings Bay area, there was not a significant difference (P=0.05) in the survival of *Mysidopsis bahia* between the control sediment from all the sample stations except E-KB01-2. Survival of *M. bahia* in E-KB01-2 DUP was also significantly different from the reference sediment.

After 10 days of exposure to sediments from the Kings Bay area, there were significant differences (P=0.05) in the survival of *L. plumulosus* between the laboratory control sediment and reference sediment and sample stations E-KB01-1, E-KB01-2, E-KB01-3 and E-KB01-2 DUP.

Finally, at the termination of the 28-day bioaccumulation tests, adequate mass of *Macoma nasuta* and *Nereis virens* tissues were available for use in chemical analyses.

Stations E-KB01-2, E-KB01-2 DUP, and E-KB01-3 were analyzed a second time as per guidance from the EPA. The sediment samples were purged of ammonia in the porewater to levels below 50 mg/L. Testing conditions were maintained to minimize ammonia throughout the 10-day test. Final day porewater analyses confirm that ammonia concentrations were well below 50 mg/L. All other parameters were within testing limits.

Survival improved for all samples except the reference sample. The reference sample was at 98% survival in the original run and at 92% in the rerun. Statistical evaluation shows that the two reference results are not statistically different.

Bioaccumulation tests with clams (*Macoma nasuta*) and worms (*Nereis virens*) indicated there was no significant accumulation of toxic metals tested that could pose concern relative to human health.

1

Introduction

1.0 INTRODUCTION

This report presents the results of our chemical, biological, and physical analysis of sediment and elutriate samples from Kings Bay as part of the 2001 103-Evaluation of Dredged Material for Ocean Disposal. Elutriate bioassay data and sediment bioassay data are also included. Sediment and water samples were collected during the period July 18-20, 2001 at eleven sample substations. Also presented are data from an area reference station consisting of two substations located near the Kings Bay ODMDS.

2

Methods and Materials

2.0 METHODS AND MATERIALS

2.1 Sample Collection Techniques

All sediment samples were collected either by vibracoring or as grab samples. Details are as follows:

Station	Sediment Collection Technique
RS-KB01-A	Van Veen Grab
RS-KB01-B	Van Veen Grab
E-KB01-1A	Vibracoring
E-KB01-1B	Vibracoring
E-KB01-1C	Vibracoring
E-KB01-2A	Vibracoring
E-KB01-2B	Vibracoring
E-KB01-2A Duplicate	Vibracoring
E-KB01-2B Duplicate	Vibracoring
E-KB01-3A	Vibracoring
E-KB01-3B	Vibracoring
E-KB01-4A	Vibracoring
E-KB01-4B	Vibracoring
E-KB01-5A	Vibracoring
E-KB01-5B	Vibracoring

Sediment and water samples were properly labeled, iced, and then transported to the laboratory via surface transportation.

Station locations are shown on the site maps in Figures 1 and 2.

2.2 *In Situ* Field Measurements

Hydrographic measurements for water temperature, pH, water depth, turbidity, dissolved oxygen, and conductivity were made using a H_2O Scout II Hydrolab with turbidimeter. Field observations were made concerning sea state, tidal cycle, and weather.

2.3 Sediment Analyses

Two to three substations were composited to derive one representative sample per sampling station (i.e., samples E-KB01-1A, E-KB01-1B, E-KB01-1C were composited to become sample E-KB01-1). After thorough mixed to maximize homogeneity, portions of each of newly composited sample were prepared and shipped to Harding ESE for bioassay testing, to Harbor Branch Environmental Laboratory (HBEL) for organics testing, and to Law Engineering for physical testing. Testing for ammonia, cyanide, solids, and heavy metals was performed by PPB Environmental Laboratories, Inc. Organotin testing and total organic carbon analyses were performed by HBEL. All testing was performed in accordance with published procedures. Specific analytical methods for sediment analytes are listed in Table 1.

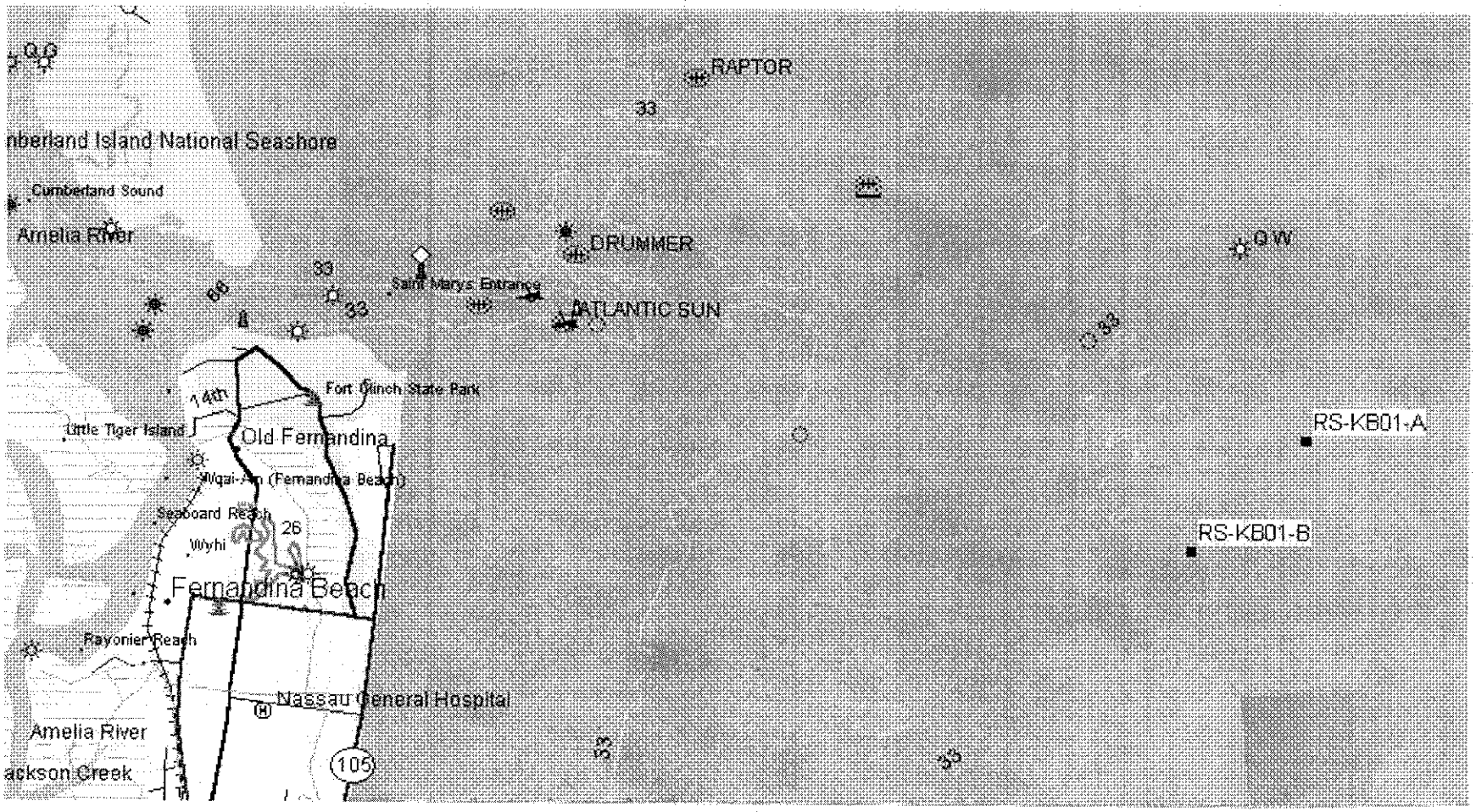

Figure 1. Reference Station Locations at Kings Bay, Georgia, Sampled July 18, 2001.

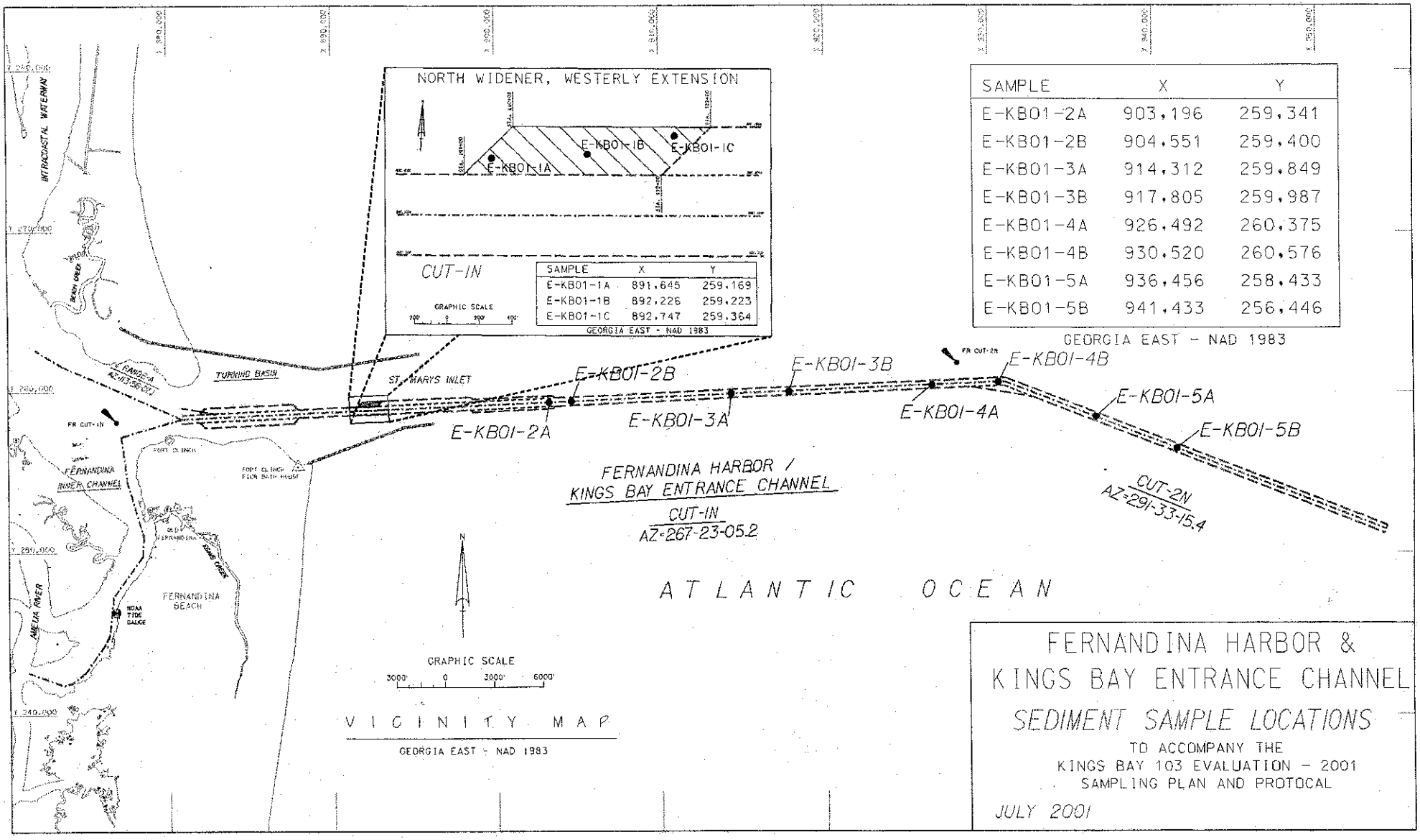

Figure 2. Sample Station Locations at Kings Bay, Georgia, Sampled July 18-20, 2001

Table 1. Sediment Analytes and Analytical Methods

Analyte	Method Number
Aluminum	EPA 6010
Arsenic	EPA 6010
Cadmium	EPA 6010
Chromium	EPA 6010
Copper	EPA 6010
Iron	EPA 6010
Lead	EPA 6010
Mercury	EPA 7471
Nickel	EPA 6010
Silver	EPA 7760
Zinc	EPA 6010
Ammonia	EPA 350.1
Total Organic Carbon	EPA 9060
Cyanide	EPA 9010
Oil and Grease	EPA 9071
Total Solids	EPA 160.2
Pesticides/PCBs	EPA 3550/8081/8082
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 3550/8270
Organic Tin	Uhler and Durrell, 1989
Grain Size	ASTM D422
Specific Gravity	ASTM D854
Atterburg Limits	ASTM D4318
Settling Rates	Corps SAD Lab Methods

Table 2. Elutriate Analytes and Analytical Methods

Analyte	Method Number
Arsenic	EPA 200.7
Cadmium	EPA 200.7
Chromium	EPA 200.7
Copper	EPA 200.7
Lead	EPA 200.7
Mercury	EPA 245.1
Nickel	EPA 200.7
Silver	EPA 272.2
Zinc	EPA 200.7
Cyanide	EPA 335.2
Ammonia	EPA 350.1
Total Organic Carbon	EPA 415.1
Total Organic Tin	Uhler and Durrell, 1989
Pesticides/PCBs	EPA 3550/8081/8082
Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 3510/8270

2.5 Bioassays

2.5.1 GENERAL PROCEDURES

Elutriate bioassays were conducted on sediments collected from the Kings Bay area to determine the potential impact of dissolved and suspended contaminants on organisms exposed to the elutriate after conducting an initial mixing period. The test organisms used for the elutriate tests included the inland silverside, *Menidia beryllina*, the mysid shrimp, *Mysidopsis bahia* (a crustacean), and gametes of the sea urchin, *Lytechinus variegatus.*

Sediment bioassays were conducted to determine the effects of the site contaminants on the infaunal amphipod, *Leptocheirus plumulosus* and the mysid shrimp, *Mysidopsis bahia.* Sediment bioaccumulation tests were also conducted with the polychaete, *Nereis virens* and the bivalve, *Macoma nasuta.*

All bioassays were conducted in accordance with the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers Standard Testing Manual entitled: *Evaluation of Dredged Material for Proposed Ocean Disposal - Testing Manual* (USEPA-503/8-91/001, February, 1991).

The test samples (six site sediments and one duplicate sediment) were collected between July 18 through July 20, 2001 and were received at the Harding ESE Toxicology Laboratory on July 25, 2001. Samples received at the Harding ESE Toxicology Laboratory were identified as E-KB01-1, E-KB01-2, E-KB01-3, E-KB01-4, E-KB01-5, and E-KB01-2 DUP. A reference sediment (RS-KB01) was also collected on July 18, 2001 and was tested concurrently with the Kings Bay site sediments. Control sediment (approximately 10 gallons) was collected by Harding ESE personnel from the Atlantic Ocean near Marineland, Florida, on July 23, 2001 for use in the control exposures of the bioassay tests. The same control sediment was used for all the bioassay tests. All samples were stored in a refrigerator at 4 ± 2°C until used, and unused portions of test samples were stored similarly during the testing period. Sample chain-of-custody and other traffic information is provided in Appendix A-1.

Test sediments were received at the Harding ESE lab in quantities of approximately 5 gallons each. Prior to use in testing, sediments were thoroughly homogenized in their original containers and sifted or hand-sorted to remove any organic debris, small rocks, and indigenous organisms.

2.5.2 ELUTRIATE BIOASSAY PROCEDURES

Two of the test species used for the elutriate bioassays, *M. beryllina* and *M. bahia*, were received from Aquatic Indicators, St. Augustine, Florida. *M. beryllina* were 10 days old and *M. bahia* were 4 days old at test initiation. Gravid adult sea urchins, *L. variegatus*, were received from Gulf Specimen Company, Panacea, Florida.

The elutriate bioassays were conducted at the Harding ESE Toxicology Laboratory from August 1 through August 5, 2001 for *M. bahia* and *M. beryllina*, and on August 16, 2001 for *L. variegatus* with laboratory control sediment and sediments from the five sample stations, plus the duplicate site sample, and the reference sample.

Natural filtered seawater collected from the Atlantic Ocean near Marineland, Florida was used as dilution and laboratory control water. The seawater was adjusted to a salinity of 20 parts per thousand (ppt) prior to use in preparing the three different elutriate concentrations for the *M. beryllina* and *M. bahia* tests. The salinity for the sea urchin test was maintained at 28 ± 1 ppt. Five replicates each of the three elutriate concentrations (10%, 50%, and 100%) of the three site sediments, the duplicate site sediment, and laboratory control sediment were tested. The laboratory control water was also tested as 0% elutriate. Elutriates were not prepared from the field reference sample. The *M. beryllina* tests were conducted in 600-mL beakers containing 300 mL of elutriate or control solution, and the *M. bahia* tests were conducted in 340-mL crystallizing dishes containing 200 mL of elutriate or control solution. Ten organisms were placed in each of the five replicate test chambers. *M. bahia* were fed three drops per replicate of brine shrimp nauplii (*Artemia* sp.) twice daily to prevent cannibalism. Twenty-milliliter (20-mL) glass scintillation vials were used as test vessels for the sea urchin tests. All tests were performed at a temperature of 20 ± 1°C and under ambient laboratory illumination (~740 lux).

Elutriates were prepared by mixing 1 part of sediment to 4 parts of water to achieve a sediment-to-water ratio of 1:4 by volume. The mixtures were mechanically stirred for 30 minutes at room temperature on a magnetic stirrer, with additional mixing by hand every 10 minutes. The mixtures were allowed to settle for at least 1 hour and then the supernatant was siphoned off as the 100% elutriate. Dilutions of the 100% elutriate were made to obtain the 50% and 10% elutriates on a volume-to-volume basis.

Water quality parameters measured daily during the 96-hour *M. bahia* and *M. beryllina* tests and at test initiation of the sea urchin tests, were D.O., pH, temperature, and salinity. Dissolved oxygen was measured with a YSI Model 55 DO meter, temperature was measured with a VWR thermocouple, pH was measured with an Orion Model SA 290A pH meter, and salinity was measured with an Aquatic Ecosystems CL893 refractometer. All instruments were calibrated daily before use. Survival counts were performed daily and at test conclusion for the *M. beryllina* and *M. bahia* elutriate tests.

L. variegatus eggs and sperm were obtained from adults by injecting approximately 1.0 mL of 0.5-M KCl solution into the mouth region. Sperm were collected neat and the eggs were collected in dilution water. The eggs were washed three times with seawater, allowing eggs to settle for 30 minutes between rinses. Approximately 5 million sperm cells were added to 5 mL of elutriate and incubated for 60 minutes at 20°C. Approximately 2,000 eggs were then added to each vial, allowing fertilization to take place. Development was halted after 20 minutes by the addition of 2 mL 10% buffered formalin. Fertilization was then quantified by the presence or absence of a fertilization membrane using a Sedgwick-Rafter counting chamber and a compound microscope. The fertilization membrane appeared as a "halo" around the sea urchin egg. For each test replicate, a total of 100 eggs were counted and any damaged eggs were not included in the counts.

ANOVAs (or nonparametric equivalent for data which did not meet the assumptions for the parametric test) were used to compare mean survivorship or fertilization in the control sediment (100% elutriate) or the control elutriate (0% elutriate) versus the 100% elutriate from each of the Kings Bay sediments. Median lethal concentration (LC_{50}) values for survival of *M. bahia* and *M. beryllina* and exposure concentration (EC_{50}) values for egg fertilization for *L. variegatus* were calculated, if necessary. The LC_{50} and EC_{50} are defined as the concentration of elutriate or reference toxicant that kills or inhibits 50% of the exposed test organisms under the specified conditions of exposure. The LC_{50} and EC_{50} values for all of the sediment elutriates with less than 50% mortality (or fertilization) were estimated as greater than 100% in accordance with EPA guidelines (EPA/503/8-91/001).

2.5.3 SEDIMENT BIOASSAY PROCEDURES

Two test species were used for the sediment bioassays, *Leptocheirus plumulosus* and *M. bahia.* Juvenile *L. plumulosus* (2-4 mm in length, with no mature males) were obtained from Aquatic Research Organisms, Hampton, New Hampshire, and *M. bahia* (4 days old at test initiation) were obtained from Aquatic Indicators, Inc. (St. Augustine, Florida).

The 10-day sediment tests with *L. plumulosus* and *M. bahia* were conducted from July 27 through August 6, 2001, with a daily photoperiod of 16-hour light and 8-hour dark cycle under fluorescent lighting conditions (~840 lux) for the duration of the tests. A second 10-day sediment test was conducted on November 9, 2001 using *L. plumulosus.* The purpose of this second run was to determine if the porewater ammonia concentrations were the cause of the low survival rate in the initial run.

The sediment tests were conducted at the Harding ESE Toxicology Laboratory using five replicates each for the: (1) laboratory control sediment, (2) one duplicate site sediment, (3) five site sediments, and (4) one reference sediment from Kings Bay. Test chambers were 1.5-liter glass jars for the *L. plumulosus* test and 1.6-liter glass Carolina bowls for the *M. bahia* test. Twenty *M. bahia* or *L. plumulosus* were loaded in each of the five replicate test chambers at test initiation. All test chambers were aerated at approximately 60-80 bubbles per minute. Aeration was supplied to the test chambers using an oil-free laboratory air compressor (Aquatic Eco Systems, Inc., Clearwater, Florida) through flexible Tygon® tubing fitted with glass pipette tips. During testing, *M. bahia* were fed three drops per replicate of brine shrimp nauplii (*Artemia* sp.) twice daily to prevent cannibalism, and *L. plumulosus* were not fed for the duration of the 10-day exposure period.

Water quality parameters measured daily during the 10-day *M. bahia* and *L. plumulosus* sediment tests were D.O., pH, temperature, ammonia, and salinity. Dissolved oxygen was measured with a YSI Model 55 DO meter, temperature was measured with a VWR thermocouple, pH was measured with an Orion Model SA 290A pH meter, and salinity was measured with an Aquatic Eco Systems CL893 refractometer. Total ammonia was measured with a SA 290A meter equipped with an Orion 95-12 ammonia probe and light intensity was measured with a lux meter. All instruments were calibrated daily before use. Survival counts were performed at test termination for all *L. plumulosus* and *M. bahia* sediment tests.

Prior to test initiation (Day-1), natural seawater (salinity of 25 ppt for *M. bahia* and 28 ppt for *L. plumulosus*) and sediments were introduced to each test chamber at a ratio of 1 part sediment to 4 parts seawater and allowed to settle overnight. The overlying water was siphoned from each of the replicate test chambers after 24 hours and new overlying water was added. Water quality parameters were measured immediately prior to adding the test organisms. Water renewals were performed at 48-hour intervals immediately after taking water quality measurements. Water was siphoned from the test chambers and placed in a glass beaker to determine that inadvertent removal of test organisms had not occurred. Any test organisms siphoned out were immediately returned to their test chambers. Clean seawater was added back into the test chambers, taking care not to resuspend the sediment. Dead brine shrimp were removed from the *M. bahia* test chambers on a daily basis.

Sediment bioassay data was evaluated by a statistical comparison of mean survivorship in the sample station sediment relative to the field reference or laboratory control average survivorship using Dunnett's procedure (EPA/600/4-89/001). Data was first checked for normality and homogeneity of variance. If either of these assumptions was not met, the data was transformed using a square-root arcsine transformation or another transformation resulting in normalization prior to analysis by Dunnett's procedure. When data could not be normalized by transformation, the data were analyzed by the equivalent nonparametric test.

2.6 Bioaccumulation Procedures

The polychaete *N. virens* and the bivalve *M. nasuta* used in the bioaccumulation study were obtained from Aquatic Research Organisms, Hampton, New Hampshire.

The bioaccumulation tests were performed for 28 days (from July 26 through August 23, 2001) using five replicates of each site sediment including the reference sediment, and the laboratory control without dilution. Three replicates were used for the duplicate sediment exposure due to the limited amount of sample. Each replicate test chamber was a 10-gallon aquarium to which 2 centimeters of sediment were added. Each of the exposure aquaria was filled with approximately 8 gallons of natural seawater with a salinity of 25 ± 2 ppt. Twenty *N. virens* and 20 *M. nasuta* were then added to each test chamber (the two species were tested in separate tanks). Test organisms were not fed at any time during the testing period.

The tests were performed under laboratory illumination (~1050 Lux) in a temperature-controlled room adjusted to maintain a constant test temperature of 18 ± 2°C. Aeration was provided to all the test chambers at approximately 100-120 bubbles per minute with the aid of an oil-free laboratory air compressor (Aquatic Eco Systems, Inc., Clearwater, Florida).

Water quality parameters measured daily during the 28-day sediment bioaccumulation tests were dissolved oxygen, pH, temperature, and salinity. Dissolved oxygen was measured with a YSI Model 55 DO meter, temperature was measured with a VWR thermocouple, pH was measured with an Orion Model SA 290A pH meter, and salinity was measured with an Aquatic Eco Systems CL893 refractometer. All instruments were calibrated daily before use. Observations were made daily for organism behavior and mortality. Survival counts were performed at test termination for all of the bioaccumulation tests.

Renewals of the overlying water in the aquaria were performed three times per week. Water was siphoned from the aquaria through 11/16-inch (outside diameter) Tygon® tubing and the aquaria were refilled with seawater pumped from a holding tank through similar tubing. The Tygon® tubing, equipped with plastic pinch clamps and tipped with plastic T-joints, was connected to PVC pipes fitted with control valves to adjust the flow of water. Care was taken to ensure that the sediment in each tank was not disturbed during renewals.

After 28 days of exposure, test organisms from each replicate were removed from the aquaria and allowed to depurate in clean seawater for 24 hours. After depuration, organisms from each replicate were rinsed in deionized water, placed into Ziploc® bags, and stored in a freezer at -10 ± 2°C. Frozen *N. virens* and *M. nasuta* tissues were archived for shipment to PPB Environmental Laboratories, Inc., Gainesville, Florida for chemical analyses (if required).

3

Results and Discussion

3.0 RESULTS AND DISCUSSION

3.1 Field Data

Results of water column measurements and field observations are presented in Tables 3 and 4. Sampling occurred from July 18-20, 2001, when water temperatures ranged from 28.5 to 29.4°C. Dissolved oxygen ranged from 5.1 to 6.8 mg/L, while the range for pH was 7.20 to 7.99. Turbidity ranged from <0.1 to 29.2 NTUs. Salinity and conductivity ranged from 34.8 to 36.2 ppt and from 52.8 to 54.5 mmhos/cm, respectively. Weather conditions varied from overcast with drizzle to sunny, and winds were light to gusty. Sea state varied from calm to a light chop.

3.2 Sediment Chemistry Data

Analytical results for sediments are presented in Tables 5, 6, 7, 8, and 9. Significant levels of aluminum are expected since aluminum is a central component of clays. Iron was also present in significant concentrations (approximately 2,500 to 14,000 μg/g, dry weight basis. Other metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were either below detection or present at low to moderate levels.

Carbon levels of 500 to 18,000 μg/g, dry weight basis, are a measure of the organic content of the samples. Additional organics testing showed little variability as all sediments were below detection for pesticides, PCBs, and PAHs. Ammonia ranged from 1.4 to 50.6 μg/g, dry weight basis. Cyanide, organotin, and oil & grease were not detected in any of the sediment samples.

Reports of Atterburg limits, specific gravity settling rates, and grain size distribution plots are presented in Appendix B.

3.3 Elutriate Chemistry Data

Analytical results for elutriates are presented in Tables 10, 11, 12, and 13. The elutriates were below detection for all metals except arsenic, which were present at levels of 59.8 μg/L for sample E-KB01-3 and 79.7 μg/L for sample E-KB01-2. This would suggest that the metals found in the sediments are rather tightly bound to sediment particles and do not readily move into solution. None of the elutriate samples contained detectable levels of pesticides, PCBs, or PAHs.

Low levels (0.063 μg/L to 0.074 μg/L) of tributyltin were found in elutriates from stations E-KB01-1 and E-KB01-5.

Dibutyltin was found at levels of 0.23 μg/L to 0.44 μg/L in samples from stations RS-KB01 and E-KB01-1.

All elutriates were below detection for cyanide. Total organic carbon ranged from 1.0 mg/L to 14 mg/L, and ammonia (as N) ranged from <0.003 mg/L to 9.80 mg/L.

Table 3. Results of *In Situ* Hydrographic Measurements at Kings Bay July 18-20, 2001

Station ID	Coordinates	Date and Time	Depth (feet)	Tidal Cycle	Sea State	Weather
RS-KB01-A	30°41.494'N 81°17.487'W	07/18/01 1035	42	Outgoing	1-2 ft.	Overcast with drizzle
RS-KB01-B	30°40.626'N 81°18.507'W	07/18/01 0845	50	Outgoing	3 ft.	Sunny, light breeze
E-KB01-1A	30°42.6299'N 81°25.0425'W	07/19/01 1115	40	Outgoing	Calm	Partly cloudy
E-KB01-1B	30°42.6411'N 81°24.9291'W	07/19/01 1150	38	Outgoing	1-2 ft.	Mostly cloudy
E-KB01-1C	30°42.6699'N 81°24.7669'W	07/20/01 1037	55	Outgoing	1 ft.	Sunny, wind west 5 kts.
E-KB01-2A	30°42.6425'N 80.22.8355'W	07/19/01 1322	50	Outgoing	1-2 ft.	Partly cloudy, wind east 5 kts.
E-KB01-2B	30°42.6552'N 81°22.5764'W	07/19/01 1403	49	Low at 1359	1-2 ft.	Partly cloudy, wind east 5 kts.
E-KB01-3A	30°42.7133'N 81°20.7100'W	07/20/01 0838	58	Slack	1 ft.	Sunny, wind west 5-10 kts.
E-KB01-3B	30°42.7308'N 81°20.0435'W	07/20/01 0920	55	Outgoing	1-3 ft.	Sunny, wind west 10 kts.
E-KB01-4A	30°42.7850'N 81°18.3860'W	07/18/01 1435	51	Incoming	1-3 ft.	Sunny, light breeze
E-KB01-4B	30°42.816'N 81°17.621'W	07/18/01 1335	49	Incoming	1-3 ft.	Sunny, light breeze
E-KB01-5A	30°42.449'N 81°16.484'W	07/18/01 1236	50	Outgoing; low at 1306	1-3 ft.	Sunny, light breeze
E-KB01-5B	30°42.118'N 81°15.540'W	07/18/01 1125	50	Outgoing	1-2 ft.	Sunny, light breeze

Table 4. Depth Profile *In Situ* Data from Kings Bay Collected July 18-20, 2001

Station ID	Sampling Depth (feet)	Temp (°C)	pH (Units)	Dissolved O_2 (ppm)	Salinity (ppt)	Conductivity (mmhos/cm)	Turbidity (NTU)
RS-KB01-A	1	28.6	7.39	6.1	35.8	54.4	0.3
	21	28.5	7.38	6.4	36.0	54.3	1.1
	37	28.5	7.36	6.8	36.0	54.5	7.2
RS-KB01-B	1	28.6	7.37	5.1	35.8	54.0	0.1
	24	28.5	7.31	5.1	35.9	54.1	2.9
	45	28.5	7.20	5.1	35.9	54.3	5.7
E-KB01-1A	1	28.7	7.78	6.1	35.5	53.6	10.8
	18	28.7	7.79	6.3	35.6	53.7	15.1
	38	28.7	7.80	6.5	35.6	53.8	21.0
E-KB01-1B	2	28.8	7.97	5.8	35.3	53.4	21.9
	20	28.7	7.99	6.1	35.4	53.5	10.7
	36	28.7	7.98	6.6	35.4	53.5	15.1
E-KB01-1C	1	29.0	7.96	6.0	35.8	54.1	3.6
	27	28.9	7.97	6.3	36.0	54.3	7.4
	49	28.8	7.95	6.6	35.9	54.2	11.3
E-KB01-2A	2	29.2	7.88	5.6	34.8	52.8	16.8
	26	28.9	7.94	5.8	35.1	53.2	17.0
	47	28.9	7.97	6.4	35.2	53.2	29.2
E-KB01-2B	2	29.2	7.88	5.4	34.9	52.8	15.2
	25	29.1	7.90	5.8	35.6	53.7	16.7
	49	29.0	7.90	6.4	35.5	53.8	26.3
E-KB01-3A	2	28.6	7.41	6.2	36.1	54.4	0.5
	30	28.6	7.39	6.6	36.0	54.4	0.9
	55	28.6	7.37	6.7	35.7	54.4	4.1
E-KB01-3B	2	28.7	7.56	5.9	35.9	54.2	0.3
	28	28.6	7.57	6.2	36.0	54.4	1.4
	54	28.6	7.55	6.6	36.1	54.5	3.5
E-KB01-4A	1	29.1	7.72	5.7	36.0	53.9	3.5
	25	28.5	7.78	5.8	36.0	54.3	0.7
	48	28.5	7.77	6.2	35.5	54.4	7.0
E-KB01-4B	1	29.4	7.80	5.6	35.9	54.0	2.0
	24	28.6	7.91	5.7	36.0	54.3	0.9
	45	28.5	7.90	6.1	36.0	54.5	2.1
E-KB01-5A	2	29.3	7.72	5.4	35.5	54.0	<0.1
	26	28.6	7.82	5.6	36.1	54.4	0.9
	44	28.5	7.83	5.9	36.1	54.4	4.3
E-KB01-5B	2	28.6	7.72	5.7	36.2	54.3	<0.1
	25	28.5	7.73	5.9	36.0	54.4	0.5
	47	28.5	7.73	6.5	36.1	54.4	2.2

Table 5. Results of Metals Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in ppm (μg/g) and presented on dry and wet weight basis] (Page 1 of 2)

Station ID	PPB #	Aluminum Dry/Wet		Arsenic Dry/Wet		Cadmium Dry/Wet		Chromium Dry/Wet		Copper Dry/Wet	
Control Sediment	208256	33,800	28,400	2.7	2.3	0.8	0.7	18.9	15.9	2.8	2.4
RS-KB01	208249	7,280	5,680	1.9	1.5	0.1	0.1	8.3	6.5	0.8	0.6
E-KB01-1	208250	3,310	2,580	2.0	1.6	0.1	0.1	2.2	1.7	0.5	0.4
E-KB01-2	208251	30,900	13,290	8.7	3.7	0.8	0.3	32.9	14.1	5.8	2.5
E-KB01-2 DUP	208252	27,100	12,200	5.8	2.6	0.7	0.3	28.2	12.7	5.0	2.2
E-KB01-3	208253	32,600	16,950	6.9	3.6	0.7	0.4	29.0	15.1	5.7	3.0
E-KB01-4	208254	12,800	9,220	2.7	1.9	0.2	0.1	11.8	8.5	1.2	0.9
E-KB01-5	208255	11,000	8,030	2.5	1.8	0.1	0.1	10.7	7.9	1.0	0.7

Table 5. Results of Metals Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in ppm (μg/g) and presented on dry and wet weight basis] (Page 2 of 2)

Station ID	PPB #	Iron		Lead		Mercury		Nickel		Silver		Zinc	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Control Sediment	208256	11,100	9,320	3.3	2.8	<0.2	<0.2	13.5	11.3	<0.1	<0.08	20.6	17.3
RS-KB01	208249	2,510	1,960	5.0	3.9	<0.2	<0.2	0.9	0.7	<0.1	<0.08	5.8	4.5
E-KB01-1	208250	1,440	1,120	2.6	2.0	<0.2	<0.2	<0.4	<0.3	<0.1	<0.08	2.9	2.3
E-KB01-2	208251	14,000	6,020	10.9	4.7	<0.2	<0.1	8.8	3.8	<0.1	<0.04	29.2	12.6
E-KB01-2 DUP	208252	11,200	5,040	8.8	4.0	<0.2	<0.1	7.6	3.4	<0.1	<0.04	25.8	11.6
E-KB01-3	208253	12,600	6,550	12.4	6.4	<0.2	<0.1	6.4	3.3	<0.1	<0.05	27.4	14.2
E-KB01-4	208254	3,710	2,670	7.3	5.2	<0.2	<0.1	1.2	0.9	<0.1	<0.07	8.0	5.8
E-KB01-5	208255	3,100	2,260	6.8	5.0	<0.2	<0.1	0.9	0.6	<0.1	<0.07	6.8	5.0

Table 6. Results of Nutrient and Other Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in μg/g (ppm) or percent and presented on dry and wet weight basis]

Station ID	PPB #	Ammonia as N (μg/g)		Total Organic Carbon (μg/g)		Oil & Grease (μg/g)		Cyanide (μg/g)		Total Solids (%)	Moisture (%)
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet		
Control Sediment	208256	4.6	3.9	750	630	<79	<66	<1.0	<0.8	84	16
RS-KB01	208249	3.8	3.0	580	450	<81	<63	<1.0	<0.8	78	22
E-KB01-1	208250	1.4	1.1	480	370	<78	<61	<1.0	<0.8	78	22
E-KB01-2	208251	47.0	20.2	18,000	7,740	<79	<34	<1.0	<0.4	43	57
E-KB01-2 DUP	208252	50.6	22.8	16,000	7,200	<79	<36	<1.0	<0.4	45	55
E-KB01-3	208253	28.2	14.7	12,000	6,240	<78	<40	<1.0	<0.5	52	48
E-KB01-4	208254	5.8	4.2	1,600	1,150	<80	<58	<1.0	<0.7	72	28
E-KB01-5	208255	4.7	3.4	940	690	<80	<58	<1.0	<0.7	73	27

Table 7. Results of Organotin Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in μg/g (ppm) and presented on dry and wet weight basis]

Station ID	PPB #	Monobutyltin (μg/g)		Dibutyltin (μg/g)		Tributyltin (μg/g)	
		Dry	Wet	Dry	Wet	Dry	Wet
Control Sediment	208256	<0.020	<0.017	<0.020	<0.017	<0.020	<0.017
RS-KB01	208249	<0.021	<0.016	<0.021	<0.016	<0.021	<0.016
E-KB01-1	208250	<0.021	<0.016	<0.021	<0.016	<0.021	<0.016
E-KB01-2	208251	<0.038	<0.017	<0.038	<0.017	<0.038	<0.017
E-KB01-2 DUP	208252	<0.038	<0.017	<0.038	<0.017	<0.038	<0.017
E-KB01-3	208253	<0.031	<0.017	<0.031	<0.017	<0.031	<0.017
E-KB01-4	208254	<0.022	<0.016	<0.022	<0.016	<0.022	<0.016
E-KB01-5	208255	<0.022	<0.016	<0.022	<0.016	<0.022	<0.016

Table 8. Results of Pesticide and PCB Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in µg/kg (ppb) or percent and presented on dry and wet weight basis] (Page 1 of 2)

Station ID:	Control Sediment		RS-KB01		E-KB01-1		E-KB01-2	
PPB #:	208256		208249		208250		208251	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Aldrin	<6	<5	<7	<5	<7	<5	<12	<6
Chlordane	<6	<5	<7	<5	<7	<5	<12	<6
4,4'-DDT	<6	<5	<7	<5	<7	<5	<12	<6
4,4'-DDD	<6	<5	<7	<5	<7	<5	<12	<6
4,4'-DDE	<6	<5	<7	<5	<7	<5	<12	<6
Dieldrin	<6	<5	<7	<5	<7	<5	<12	<6
Endosulfan I	<6	<5	<7	<5	<7	<5	<12	<6
Endosulfan II	<6	<5	<7	<5	<7	<5	<12	<6
Endosulfan sulfate	<6	<5	<7	<5	<7	<5	<12	<6
Endrin	<6	<5	<7	<5	<7	<5	<12	<6
Endrin aldehyde	<6	<5	<7	<5	<7	<5	<12	<6
Heptachlor	<6	<5	<7	<5	<7	<5	<12	<6
Heptachlor epoxide	<6	<5	<7	<5	<7	<5	<12	<6
Lindane	<6	<5	<7	<5	<7	<5	<12	<6
Toxaphene	<54	<45	<62	<50	<61	<49	<120	<52
Methoxychlor	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1016	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1221	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1232	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1242	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1248	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1254	<21	<18	<25	<20	<24	<19	<48	<21
PCB-1260	<27	<23	<31	<25	<31	<24	<59	<26

Table 8. Results of Pesticide and PCB Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in µg/kg (ppb) or percent and presented on dry and wet weight basis] (Page 2 of 2)

Station ID:	E-KB01-2 DUP		E-KB01-3		E-KB01-4		E-KB01-5	
PPB #:	208252		208253		208254		208255	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Aldrin	<11	<5	<9	<5	<7	<5	<7	<5
Chlordane	<11	<5	<9	<5	<7	<5	<7	<5
4,4'-DDT	<11	<5	<9	<5	<7	<5	<7	<5
4,4'-DDD	<11	<5	<9	<5	<7	<5	<7	<5
4,4'-DDE	<11	<5	<9	<5	<7	<5	<7	<5
Dieldrin	<11	<5	<9	<5	<7	<5	<7	<5
Endosulfan I	<11	<5	<9	<5	<7	<5	<7	<5
Endosulfan II	<11	<5	<9	<5	<7	<5	<7	<5
Endosulfan sulfate	<11	<5	<9	<5	<7	<5	<7	<5
Endrin	<11	<5	<9	<5	<7	<5	<7	<5
Endrin aldehyde	<11	<5	<9	<5	<7	<5	<7	<5
Heptachlor	<11	<5	<9	<5	<7	<5	<7	<5
Heptachlor epoxide	<11	<5	<9	<5	<7	<5	<7	<5
Lindane	<11	<5	<9	<5	<7	<5	<7	<5
Toxaphene	<110	<49	<88	<46	<65	<47	<63	<47
Methoxychlor	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1016	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1221	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1232	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1242	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1248	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1254	<45	<20	<35	<19	<26	<19	<25	<19
PCB-1260	<57	<25	<44	<23	<33	<24	<32	<24

Table 9. Results of Polynuclear Aromatic Hydrocarbons Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in µg/g (ppm) and presented on dry and wet weight basis] (Page 1 of 2)

Station ID:	Control Sediment		RS-KB01		E-KB01-1		E-KB01-2	
PPB #:	208256		208249		208250		208251	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Acenaphthene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Acenaphthlyene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Anthracene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Benzo(a)anthracene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Benzo(a)pyrene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Benzo(g,h,i)perylene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Benzo(k)fluoranthene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Benzo(b)fluoranthene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Chrysene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Dibenzo(a,h)anthracene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Fluoranthene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Fluorene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Indeno(1,2,3-cd)pyrene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Methylnaphthalene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Naphthalene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Phenanthrene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110
Pyrene	<0.120	<0.110	<0.140	<0.110	<0.140	<0.110	<0.250	<0.110

Table 9. Results of Polynuclear Aromatic Hydrocarbons Analyses for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in μg/g (ppm) and presented on dry and wet weight basis] (Page 2 of 2)

Station ID:	E-KB01-2 DUP		E-KB01-3		E-KB01-4		E-KB01-5	
PPB #:	208252		208253		208254		208255	
	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
Acenaphthene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Acenaphthlyene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Anthracene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Benzo(a)anthracene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Benzo(a)pyrene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Benzo(g,h,i)perylene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Benzo(k)fluoranthene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Benzo(b)fluoranthene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Chrysene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Dibenzo(a,h)anthracene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Fluoranthene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Fluorene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Indeno(1,2,3-cd)pyrene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Methylnaphthalene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Naphthalene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Phenanthrene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088
Pyrene	<0.230	<0.100	<0.190	<0.100	<0.130	<0.093	<0.120	<0.088

Table 10. Results of Metals Analyses for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001 [All data reported as micrograms per liter (μg/L)]

Station ID	PPB #	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Silver	Zinc
Background Water	208608	<50	<0.5	**0.5**	<4.0	<2.4	<0.1	<10	<1.0	<20
Control Sediment	208607	<50	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
RS-KB01	208600	<50	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-1	208601	<50	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-2	208602	**76.3**	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-2 DUP	208603	**79.7**	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-3	208604	**59.8**	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-4	208605	<50	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20
E-KB01-5	208606	<50	<0.5	<0.5	<4.0	<2.4	<0.1	<10	<1.0	<20

Table 11. Results of Cyanide, Total Organic Carbon, Ammonia, and Organotin Compounds Analyses for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001

Station ID	PPB #	Cyanide (mg/L)	Total Organic Carbon (mg/L)	Ammonia (as N) (mg/L)	Monobutyl Tin (μg/L)	Dibutyl Tin (μg/L)	Tributyl Tin (μg/L)
Background Water	208608	<0.004	**1.0**	<0.003	<0.050	<0.050	<0.050
Control Sediment	208607	<0.004	**2.0**	**2.12**	<0.050	<0.050	<0.050
RS-KB01	208600	<0.004	**14**	**0.86**	<0.050	**0.44**	<0.050
E-KB01-1	208601	<0.004	**2.0**	**0.32**	<0.050	**0.23**	**0.063**
E-KB01-2	208602	<0.004	**6.0**	**8.62**	<0.051	<0.051	<0.051
E-KB01-2 DUP	208603	<0.004	**7.0**	**9.80**	<0.051	<0.051	<0.051
E-KB01-3	208604	<0.004	**5.0**	**7.18**	<0.050	<0.050	<0.050
E-KB01-4	208605	<0.004	**5.0**	**2.16**	<0.050	<0.050	<0.050
E-KB01-5	208606	<0.004	**3.0**	**1.50**	<0.050	<0.050	**0.074**

Table 12. Results of Pesticide and PCB Analyses for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported as micrograms per liter (μg/L)] (Page 1 of 2)

Station ID:	Background Water	Control Sediment	RS-KB01	E-KB01-1	E-KB01-2
PPB #:	208608	208607	208600	208601	208602
Aldrin	<0.050	<0.050	<0.050	<0.050	<0.051
alpha-BHC	<0.050	<0.050	<0.050	<0.050	<0.051
beta-BHC	<0.050	<0.050	<0.050	<0.050	<0.051
gamma-BHC (Lindane)	<0.050	<0.050	<0.050	<0.050	<0.051
delta-BHC	<0.050	<0.050	<0.050	<0.050	<0.051
Chlordane	<0.050	<0.050	<0.050	<0.050	<0.051
4,4'-DDD	<0.050	<0.050	<0.050	<0.050	<0.051
4,4'-DDE	<0.050	<0.050	<0.050	<0.050	<0.051
4,4'-DDT	<0.050	<0.050	<0.050	<0.050	<0.051
Dieldrin	<0.050	<0.050	<0.050	<0.050	<0.051
Endosulfan I	<0.050	<0.050	<0.050	<0.050	<0.051
Endosulfan II	<0.050	<0.050	<0.050	<0.050	<0.051
Endosulfan sulfate	<0.050	<0.050	<0.050	<0.050	<0.051
Endrin	<0.050	<0.050	<0.050	<0.050	<0.051
Endrin aldehyde	<0.050	<0.050	<0.050	<0.050	<0.051
Methoxychlor	<0.20	<0.20	<0.20	<0.20	<0.20
Heptachlor	<0.050	<0.050	<0.050	<0.050	<0.051
Heptachlor epoxide	<0.050	<0.050	<0.050	<0.050	<0.051
Toxaphene	<1.0	<1.0	<1.0	<1.0	<1.0
PCB-1016	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1221	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1232	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1242	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1248	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1254	<0.050	<0.050	<0.050	<0.050	<0.051
PCB-1260	<0.050	<0.050	<0.050	<0.050	<0.051

Table 12. Results of Pesticide and PCB Analyses for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported as micrograms per liter (μg/L)] (Page 2 of 2)

Station ID:	E-KB01-2 DUP	E-KB01-3	E-KB01-4	E-KB01-5
PPB #:	208603	208604	208605	208606
Aldrin	<0.051	<0.050	<0.051	<0.050
alpha-BHC	<0.051	<0.050	<0.051	<0.050
beta-BHC	<0.051	<0.050	<0.051	<0.050
gamma-BHC (Lindane)	<0.051	<0.050	<0.051	<0.050
delta-BHC	<0.051	<0.050	<0.051	<0.050
Chlordane	<0.051	<0.050	<0.051	<0.050
4,4'-DDD	<0.051	<0.050	<0.051	<0.050
4,4'-DDE	<0.051	<0.050	<0.051	<0.050
4,4'-DDT	<0.051	<0.050	<0.051	<0.050
Dieldrin	<0.051	<0.050	<0.051	<0.050
Endosulfan I	<0.051	<0.050	<0.051	<0.050
Endosulfan II	<0.051	<0.050	<0.051	<0.050
Endosulfan sulfate	<0.051	<0.050	<0.051	<0.050
Endrin	<0.051	<0.050	<0.051	<0.050
Endrin aldehyde	<0.051	<0.050	<0.051	<0.050
Methoxychlor	<0.20	<0.20	<0.20	<0.20
Heptachlor	<0.051	<0.050	<0.051	<0.050
Heptachlor epoxide	<0.051	<0.050	<0.051	<0.050
Toxaphene	<1.0	<1.0	<1.0	<1.0
PCB-1016	<0.051	<0.050	<0.051	<0.050
PCB-1221	<0.051	<0.050	<0.051	<0.050
PCB-1232	<0.051	<0.050	<0.051	<0.050
PCB-1242	<0.051	<0.050	<0.051	<0.050
PCB-1248	<0.051	<0.050	<0.051	<0.050
PCB-1254	<0.051	<0.050	<0.051	<0.050
PCB-1260	<0.051	<0.050	<0.051	<0.050

Table 13. Results of Polynuclear Aromatic Hydrocarbons Analysis for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001 [All data reported as micrograms per liter (μg/L)] (Page 1 of 2)

Station ID:	Background Water	Control Sediment	RS-KB01	E-KB01-1	E-KB01-2
PPB #:	208608	208607	208600	208601	208602
Acenaphthene	<5.0	<5.2	<5.1	<5.1	<5.1
Acenaphthlyene	<5.0	<5.2	<5.1	<5.1	<5.1
Anthracene	<5.0	<5.2	<5.1	<5.1	<5.1
Benzo(a)anthracene	<5.0	<5.2	<5.1	<5.1	<5.1
Benzo(a)pyrene	<5.0	<5.2	<5.1	<5.1	<5.1
Benzo(g,h,i)perylene	<5.0	<5.2	<5.1	<5.1	<5.1
Benzo(k)fluoranthene	<5.0	<5.2	<5.1	<5.1	<5.1
Benzo(b)fluoranthene	<5.0	<5.2	<5.1	<5.1	<5.1
Chrysene	<5.0	<5.2	<5.1	<5.1	<5.1
Dibenzo(a,h)anthracene	<5.0	<5.2	<5.1	<5.1	<5.1
Fluoranthene	<5.0	<5.2	<5.1	<5.1	<5.1
Fluorene	<5.0	<5.2	<5.1	<5.1	<5.1
Indeno(1,2,3-cd)pyrene	<5.0	<5.2	<5.1	<5.1	<5.1
Methylnaphthalene	<5.0	<5.2	<5.1	<5.1	<5.1
Naphthalene	<5.0	<5.2	<5.1	<5.1	<5.1
Phenanthrene	<5.0	<5.2	<5.1	<5.1	<5.1
Pyrene	<5.0	<5.2	<5.1	<5.1	<5.1

Table 13. Results of Polynuclear Aromatic Hydrocarbons Analysis for Elutriates from Sediments Collected at Kings Bay on July 18-20, 2001 [All data reported as micrograms per liter (μg/L)] (Page 2 of 2)

Station ID:	E-KB01-2 DUP	E-KB01-3	E-KB01-4	E-KB01-5
PPB #:	208603	208604	208605	208606
Acenaphthene	<5.1	<5.0	<5.2	<5.1
Acenaphthlyene	<5.1	<5.0	<5.2	<5.1
Anthracene	<5.1	<5.0	<5.2	<5.1
Benzo(a)anthracene	<5.1	<5.0	<5.2	<5.1
Benzo(a)pyrene	<5.1	<5.0	<5.2	<5.1
Benzo(g,h,i)perylene	<5.1	<5.0	<5.2	<5.1
Benzo(k)fluoranthene	<5.1	<5.0	<5.2	<5.1
Benzo(b)fluoranthene	<5.1	<5.0	<5.2	<5.1
Chrysene	<5.1	<5.0	<5.2	<5.1
Dibenzo(a,h)anthracene	<5.1	<5.0	<5.2	<5.1
Fluoranthene	<5.1	<5.0	<5.2	<5.1
Fluorene	<5.1	<5.0	<5.2	<5.1
Indeno(1,2,3-cd)pyrene	<5.1	<5.0	<5.2	<5.1
Methylnaphthalene	<5.1	<5.0	<5.2	<5.1
Naphthalene	<5.1	<5.0	<5.2	<5.1
Phenanthrene	<5.1	<5.0	<5.2	<5.1
Pyrene	<5.1	<5.0	<5.2	<5.1

3.4 Bioassay Data

3.4.1 ELUTRIATE BIOASSAY DATA

Test conditions for the elutriate bioassay tests, including temperature, dissolved oxygen, and pH levels, were maintained at acceptable levels throughout the testing period. Salinities for the tests slightly exceeded the recommended test range; however, the test organisms did not appear to be affected by the salinity variation. Complete copies of the laboratory raw data are provided in Appendices A-2, A-3, and A-4 for *M. bahia*, *M. beryllina*, and *L. variegatus*, respectively.

Mysidopsis bahia

Survivorship data from elutriate bioassays of control water (0% elutriate), control sediment elutriate, and the five sample stations plus duplicate are presented in Table 14. Survival of *M. bahia* was 94% in the control water (0% elutriate) and 90% in the elutriate control sediment (100% control elutriate). Test station sample survivorship ranged from 76% (100% exposure for E-KB01-1) to 96% (10% exposure for E-KB01-5) (Table 14).

Based on the results of the survival counts, there were no significant differences (P=0.05) in the survivorship of *M. bahia* between the control water (0% elutriate) or control sediment and sample stations E-KB01-1, E-KB01-2, E-KB01-3, E-KB01-4, E-KB01-5, and E-KB01-2 DUP for the 100% elutriate concentrations prepared from the site sediments (Table 15).

Table 14. 96-Hour *Mysidopsis bahia* Survival Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Page 1 of 2)

Sample	Replicate	Number of Survivors[a]
CONTROL	A	10
	B	9
	C	9
	D	9
	E	10
	Total	47
	Percent	94%

Sample	Replicate	Elutriate Concentration		
		10%	50%	100%
CONTROL SEDIMENT	A	9	9	9
	B	10	9	9
	C	10	9	9
	D	10	9	9
	E	10	9	9
	Total	49	45	45
	Percent	98%	90%	90%
E-KB01-1	A	9	9	9
	B	8	9	7
	C	10	10	7
	D	9	8	7
	E	10	8	8
	Total	46	44	38
	Percent	92%	88%	76%
E-KB01-2	A	9	7	8
	B	10	8	8
	C	10	9	8
	D	9	9	9
	E	9	8	7
	Total	47	41	40
	Percent	94%	82%	80%

Table 14. 96-Hour *Mysidopsis bahia* Survival Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Page 2 of 2)

Sample	Replicate	Elutriate Concentration		
		10%	50%	100%
E-KB01-3	A	8	9	9
	B	9	8	8
	C	8	9	7
	D	8	8	7
	E	9	9	10
	Total	42	43	41
	Percent	84%	86%	82%
E-KB01-4	A	9	10	9
	B	10	8	9
	C	8	7	9
	D	8	8	9
	E	9	9	9
	Total	44	42	45
	Percent	88%	84%	90%
E-KB01-5	A	10	8	10
	B	9	9	9
	C	10	9	10
	D	9	9	9
	E	10	9	8
	Total	48	44	46
	Percent	96%	88%	92%
E-KB01-2 DUP	A	10	9	9
	B	10	10	8
	C	9	8	8
	D	8	8	9
	E	9	8	8
	Total	46	43	42
	Percent	92%	86%	84%

a - Based upon 50 organisms exposed.

Table 15. Summary of Steel's Many-One Rank Test of Control Water (0% Elutriate) or Control Sediment (100% Elutriate) and Test Sediment (100% Elutriate) on *Mysidopsis bahia* Survival for Sediments Collected from Kings Bay, July 18-20, 2001

Mysidopsis bahia Control Water (0% Elutriate) vs. Other Sample

Sample ID	$\alpha = 0.05$	Mean in Original Units	Rank Sum	Critical+ Value
Control Water (0% Elutriate)	=	9.4		
E-KB01-1 (100%)	=	7.6	16.5	16.0
E-KB01-2 (100%)	=	8.0	16.5	16.0
E-KB01-3 (100%)	=	8.2	20.5	16.0
E-KB01-4 (100%)	=	9.0	24.0	16.0
E-KB01-5 (100%)	=	9.2	26.0	16.0
E-KB01-2 DUP (100%)	=	8.4	18.0	16.0
Control Sediment (100%)	=	9.0	24.0	16.0

= Indicates no significant difference between the sample station and the control water
* Indicates a significant difference exists between the sample station and the control water
+ Critical values are 1 tailed (k = 7)
Degree of Freedom = 5.00

Mysidopsis bahia Control Sediment (100% Elutriate) vs. Other Sample

Sample ID	$\alpha = 0.05$	Mean in Original Units	Rank Sum	Critical+ Value
Control Sediment	=	9.0		
E-KB01-1 (100%)	=	7.6	17.0	16.0
E-KB01-2 (100%)	=	8.0	17.0	16.0
E-KB01-3 (100%)	=	8.2	22.0	16.0
E-KB01-4 (100%)	=	9.0	27.5	16.0
E-KB01-5 (100%)	=	9.2	29.0	16.0
E-KB01-2 DUP (100%)	=	8.4	19.0	16.0

= Indicates no significant difference between the sample station and the control water
* Indicates a significant difference exists between the sample station and the control water
+ Critical values are 1 tailed (k = 6)
Degree of Freedom = 5.00

Menidia beryllina

Survivorship data from elutriate bioassays of control water (0% elutriate), control sediment elutriate, five sample stations, and one duplicate station are presented in Table 16. Survivorship of *M. beryllina* was 100% in both the control water (0% elutriate) and the control sediment (100% elutriate). Test station sample survivorship ranged from 86% (E-KB01-3) to 100% (E-KB01-1, 100% elutriate and E-KB01-2 DUP, 10% elutriate) (Table 16).

Based on the results of the survival counts, there were no significant differences (P=0.05) between the survivorship of *M. beryllina* in the control water (0% elutriate) or control sediment (100% elutriate) and survivorship in the 100% elutriate concentration prepared from the site sediment for E-KB01-1, E-KB01-2, E-KB01-3, E-KB01-4, E-KB01-5, and E-KB01-2 DUP (Table 17).

Lytechinus variegatus

Fertilization data from the elutriate bioassays of control sediment, five sample stations, and one duplicate station are presented in Table 18. Fertilization of *L. variegatus* gametes was 69% in the control water (0% elutriate) and 71% in the 100% elutriate control sediment. Fertilization of *L. variegatus* gametes in the site samples ranged from 52% (50% elutriate from sample station E-KB01-3) to 73% (50% elutriate from sample station E-KB01-2 DUP) (Table 18).

There were no significant differences (P=0.05) in the fertilization of *L. variegatus* between the control water (0% elutriate) and control sediment (100% elutriate) when compared to the Kings Bay sample stations (Table 19).

Table 16. 96-Hour *Menidia beryllina* Survival Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Page 1 of 2)

Sample	Replicate	Number of Survivors[a]
CONTROL	A	10
	B	10
	C	10
	D	10
	E	10
	Total	50
	Percent	100%

Sample	Replicate	Elutriate Concentration		
		10%	50%	100%
CONTROL SEDIMENT	A	10	10	10
	B	10	10	10
	C	10	10	10
	D	10	10	10
	E	9	9	10
	Total	49	49	50
	Percent	98%	98%	100%
E-KB01-1	A	10	10	10
	B	8	10	10
	C	10	10	10
	D	10	7	10
	E	10	10	10
	Total	48	47	50
	Percent	96%	94%	100%
E-KB01-2	A	10	10	10
	B	9	10	10
	C	10	10	10
	D	10	9	9
	E	10	10	10
	Total	49	49	49
	Percent	98%	98%	98%

Table 16. 96-Hour *Menidia beryllina* Survival Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Page 2 of 2)

Sample	Replicate	Elutriate Concentration		
		10%	50%	100%
E-KB01-3	A	10	10	10
	B	10	10	9
	C	9	10	9
	D	9	10	8
	E	10	10	7
	Total	48	50	43
	Percent	96%	100%	86%
E-KB01-4	A	10	10	10
	B	10	9	9
	C	10	10	10
	D	10	9	10
	E	9	10	9
	Total	49	48	48
	Percent	98%	96%	96%
E-KB01-5	A	10	10	9
	B	9	10	10
	C	10	10	10
	D	10	10	10
	E	10	10	10
	Total	49	50	49
	Percent	98%	100%	98%
E-KB01-2 DUP	A	10	10	10
	B	10	9	10
	C	10	10	9
	D	10	10	8
	E	10	9	8
	Total	50	48	45
	Percent	100%	96%	90%

a - Based upon 50 organisms exposed.

Table 17. Summary of Steel's Many-One Rank Test of Control Water (0% Elutriate) or Control Sediment (100% Elutriate) and Test Sediment (100% Elutriate) on *Menidia beryllina* Survival for Sediments Collected from Kings Bay, July 18-20, 2001

Menidia beryllina Control Water (0% Elutriate) vs. Other Sample

Sample ID	$\alpha = 0.05$	Mean in Original Units	Rank Sum	Critical+ Value
Control Water (0% Elutriate)	=	10.0		
E-KB01-1 (100%)	=	10.0	27.5	16.0
E-KB01-2 (100%)	=	9.8	23.0	16.0
E-KB01-3 (100%)	=	8.6	17.0	16.0
E-KB01-4 (100%)	=	9.6	21.0	16.0
E-KB01-5 (100%)	=	9.8	23.0	16.0
E-KB01-2 DUP (100%)	=	9.0	19.0	16.0
Control Sediment (100%)	=	10.0	27.5	16.0

= Indicates no significant difference between the sample station and the control water
* Indicates a significant difference exists between the sample station and the control water
+ Critical values are 1 tailed (k = 7)
Degree of Freedom = 5.00

Menidia beryllina Control Sediment (100% Elutriate) vs. Other Sample

Sample ID	$\alpha = 0.05$	Mean in Original Units	Rank Sum	Critical+ Value
Control Sediment	=	9.0		
E-KB01-1 (100%)	=	7.6	17.0	16.0
E-KB01-2 (100%)	=	8.0	17.0	16.0
E-KB01-3 (100%)	=	8.2	22.0	16.0
E-KB01-4 (100%)	=	9.0	27.5	16.0
E-KB01-5 (100%)	=	9.2	29.0	16.0
E-KB01-2 DUP (100%)	=	8.4	19.0	16.0

= Indicates no significant difference between the sample station and the control water
* Indicates a significant difference exists between the sample station and the control water
+ Critical values are 1 tailed (k = 6)
Degree of Freedom = 5.00

Table 18. Sea Urchin, *Lytechinus variegatus*, Fertilization Test Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Percent Fertilization in Parenthesis) (Page 1 of 2)

Sample	Replicate	Number Fertilized
CONTROL	A	80
	B	62
	C	64
	Total	206
	Percent	69%

Sample	Replicate	Concentrations		
		10%	50%	100%
CONTROL SEDIMENT	A	75	63	58
	B	61	76	72
	C	80	70	82
	Total	216	209	212
	Percent	72%	70%	71%
E-KB01-1	A	63	66	70
	B	60	59	58
	C	70	68	63
	Total	193	193	191
	Percent	64%	64%	64 %
E-KB01-2	A	75	64	69
	B	66	80	72
	C	61	60	60
	Total	202	204	201
	Percent	67%	68%	67%
E-KB01-3	A	60	61	58
	B	54	60	63
	C	69	52	54
	Total	183	173	175
	Percent	61%	58%	58%

Table 18. Sea Urchin, *Lytechinus variegatus*, Fertilization Test Counts and Percentages in Three Elutriate Concentrations Prepared from Sediments Collected from Kings Bay, July 18-20, 2001 (Percent Fertilization in Parenthesis) (Page 2 of 2)

Sample	Replicate	Concentrations		
		10%	50%	100%
E-KB01-4	A	60	76	82
	B	73	70	63
	C	80	69	71
	Total	213	215	216
	Percent	71%	72%	72%
E-KB01-5	A	65	60	73
	B	69	73	58
	C	71	59	62
	Total	205	192	193
	Percent	68%	64%	64 %
E-KB01-2 DUP	A	75	68	78
	B	70	82	71
	C	63	70	63
	Total	208	220	212
	Percent	69%	73%	71%

[a]One hundred eggs counted per replicate
[b]Control: filtered natural seawater
[c]Percent concentrations of elutriate

Table 19. Summary of ANOVA and Dunnett's Test of Seawater Control (0% Elutriate) or Control Sediment (100% Elutriate) and Test Sediment (100% Elutriate) on *Lytechinus variegatus* Fertilization for Sediments Collected from Kings Bay, July 18-20, 2001 (Page 1 of 2)

Lytechinus variegatus Control Seawater vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	7	443.83	63.40	0.93
Within Means	16	1092.00	68.25	
Total	23	1535.83		

Critical F = 2.66 (a = 0.05, df = 7,16)
Since F < Critical F fail to reject H_o: all groups equal;
with a = 0.05, and 7, 16, df.

Dunnett's Test

Critical T = 2.56

Sample ID	$\alpha = 0.05$	Difference Between Means	T Stat
Seawater Control (0% Elutriate)	-	-	-
E-KB01-1 (100%)	=	5.0	0.74
E-KB01-2 (100%)	=	1.7	0.24
E-KB01-3 (100%)	=	10.3	1.53
E-KB01-4 (100%)	=	-3.3	- 0.49
E-KB01-5 (100%)	=	4.3	0.64
E-KB01-2 DUP (100%)	=	-2.0	-0.30
Control Sediment (100%)	=	-2.0	-0.30

= Indicates no significant difference between the sample station and the control water

Table 19. Summary of ANOVA and Dunnett's Test of Seawater Control (0% Elutriate) or Control Sediment (100% Elutriate) and Test Sediment (100% Elutriate) on *Lytechinus variegatus* Fertilization for Sediments Collected from Kings Bay, July 18-20, 2001 (Page 2 of 2)

Lytechinus variegatus Control Sediment vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	6	433.33	72.22	1.13
Within Means	14	897.33	64.10	
Total	20	1330.67		

Critical F = 2.85 (a = 0.05, df = 6,14)
Since F < Critical F fail to reject H_o: all groups equal;
with a = 0.05, and 6, 14, df.

Dunnett's Test

Critical T = 2.53

Sample ID	$\alpha = 0.05$	Difference Between Means	T Stat
Sediment Control (0% Elutriate)	-	-	-
E-KB01-1 (100%)	=	7.0	1.07
E-KB01-2 (100%)	=	3.7	0.56
E-KB01-3 (100%)	=	12.3	1.88
E-KB01-4 (100%)	=	-1.3	-0.20
E-KB01-5 (100%)	=	6.3	0.97
E-KB01-2 DUP (100%)	=	0.0	0.00

= Indicates no significant difference between the sample station and the control sediment

Median Lethal Concentration

Exposure of *M. bahia* to elutriates prepared from sediments from the Kings Bay sample stations and one duplicate station resulted in less than 50% mortality for all of the sample stations. Consequently, the LC_{50} values for the *M. bahia* tests were estimated to be greater than 100%, for all the sample stations including the duplicate station, as determined in accordance with EPA/503/8-91/001 (Table 20).

Exposure of *M. beryllina* to elutriates prepared from sediments from all the sample stations resulted in less than 50% mortality for all sample stations (Table 20). Consequently, the LC_{50} values for the *M. beryllina* tests were estimated to be greater than 100%, for all the sample stations including the duplicate station, as determined in accordance with EPA/503/8-91/001 (Table 20).

Exposure of *L. variegatus* gametes to elutriates prepared from sediments from the sample stations and one duplicate station resulted in greater than 50% fertilization rates in all of the elutriates tested. Consequently, the EC_{50} values for the *L. variegatus* tests were all estimated to be greater than 100% for all the stations, in accordance with EPA/503/8-91/001.

Reference Toxicant Tests

Monthly reference toxicant tests were conducted to determine the general health of each test species. The reference toxicant for the *M. bahia* and *M. beryllina* tests was sodium dodecyl sulfate (SDS) with a test duration of 48 hours. The reference toxicant for the sea urchin tests was copper sulfate ($CuSO_4$) with a duration of 80 minutes and was performed concurrently with the fertilization tests. The 48-hour LC_{50} results for *M. bahia* was 9.13 mg SDS/L (95% confidence limits of 7.20 to 11.58 mg SDS/L) and that for *M. beryllina* was 2.20 mg SDS/L (95% confidence limits of 1.79 to 2.70 mg SDS/L). Finally, the reference toxicant LC_{50} for the sea urchin was 134.56 μg $CuSO_4$/L (95% confidence limits of 120.83 to 139.11 μg $CuSO_4$/L). The LC_{50} values were within historical Harding ESE values and indicate that the test organisms were within their normal sensitivity ranges. The reference toxicant data sheets and the LC_{50} calculations for the elutriate tests are presented in Appendix A-5.

Table 20. LC_{50} (*Mysidopsis bahia, Menidia beryllina)* and EC_{50} (*Lytechinus variegatus*) Values[a] for Elutriate Bioassays Conducted on Kings Bay Sediments Collected July 18-20, 2001

Sample ID	*Mysidopsis bahia*	*Menidia beryllina*	*Lytechinus variegatus*
Control Sediment	>100%	>100%	>100%
Station E-KB01-1	>100%	>100%	>100%
Station E-KB01-2	>100%	>100%	>100%
Station E-KB01-3	>100%	>100%	>100%
Station E-KB01-4	>100%	>100%	>100%
Station E-KB01-5	>100%	>100%	>100%
Station E-KB01-2 DUP	>100%	>100%	>100%

[a] LC_{50} and EC_{50} values recorded as greater than 100% had greater than 50% survivorship.

3.4.2 SEDIMENT BIOASSAY DATA

Sediment bioassay test conditions, including temperature, DO, and pH were maintained at acceptable levels throughout the testing period. Salinity variations for the sediment tests slightly exceeded the recommended test range, however the test organisms did not appear to be affected by the salinity variation. A combination of frequent overlying water renewals were used to bring the salinity to acceptable levels. Ammonia was detected in the various samples in varying concentrations ranging from non-detect (<0.1 mg/L as nitrogen), to a maximum concentration of 1.75 mg/L as nitrogen in sample E-KB01-1. The relevant laboratory raw data pertaining to the sediment tests are provided in Appendices A-6 and A-7 for *M. bahia* and *L. plumulosus*, respectively.

Mysidopsis bahia

M. bahia survivorship was 90% in the laboratory control sediment and 96% in the reference sediment, RS-KB01 (Table 21). Survivorship of *M. bahia* in site sediments ranged from 79% (Station E-KB01-2 DUP) to 94% (Station E-KB01-5). Surviving *M. bahia* appeared healthy at test termination. *M. bahia* survivorship between replicates was relatively uniform (Appendix A-6).

Statistical analysis indicated that the survival of *M. bahia* in the laboratory control sediment was not significantly different (P=0.05) from survival in any samples except E-KB01-2 DUP (Table 22). Survival of *M. bahia* in the reference sediment was also significantly different (p=0.05) from survival in samples E-KB01-2 DUP (Table 22). Survival in E-KB01-2 DUP, however, was still quite high at 79%.

Leptocheirus plumulosus

L. plumulosus survivorship was 94% in the laboratory control sediment and 98% in the reference sediment (Table 23). Survivorship of *L. plumulosus* in the site sediments ranged from 59% (station E-KB01-1) to 98% (station E-KB01-5). Surviving *L. plumulosus* appeared healthy at the termination of the tests.

Statistical analysis using Dunnett's T-test indicated that the survival of *L. plumulosus* in the laboratory control sediment was significantly different (P=0.05) from survival in Kings Bay samples E-KB01-1, E-KB01-2, E-KB01-3 and E-KB01-2 DUP (Table 24). Similarly, survival of *L. plumulosus* in the reference sediment was statistically different (by Steel's Many One Rank Test) from the site samples E-KB01-1, E-KB01-2, E-KB01-3, and E-KB01-2 DUP (Table 24).

Reference Toxicant Tests

Reference toxicant tests were conducted on each species tested in the sediment tests. The reference toxicant used for *M. bahia* was SDS and the duration of the test was 48 hours. The reference toxicant used for *L. plumulosus* was cadmium chloride ($CdCl_2$), measured as Cd, for a duration of 96 hours. The 48-hour LC_{50} results for *M. bahia* was 9.13 mg SDS/L (95% confidence limits of 7.20 to 11.58 mg SDS/L) and the 96-hour LC_{50} results for *L. plumulosus* was 1.78 mg Cd/L (95% confidence limits of 1.33 to 2.39 mg Cd/L). The LC_{50} values were within historical Harding ESE values and indicated that the test organisms were within their normal sensitivity ranges. The reference toxicant data sheets and LC_{50} calculations for the sediment tests are presented in Appendix A-8.

Table 21. 10-Day Sediment *Mysidopsis bahia* Survival, Kings Bay Sediments Collected July 18-20, 2001 (Page 1 of 2)

Sample	Replicate	Number of Survivors[a]
CONTROL SEDIMENT	A	18
	B	19
	C	17
	D	18
	E	18
	Total	90
	Percent	90%
E-KB01-1	A	19
	B	17
	C	19
	D	15
	E	16
	Total	86
	Percent	86%
E-KB01-2	A	15
	B	19
	C	16
	D	17
	E	18
	Total	85
	Percent	85%
E-KB01-3	A	18
	B	19
	C	17
	D	17
	E	19
	Total	90
	Percent	90%

Table 21. 10-Day Sediment *Mysidopsis bahia* Survival, Kings Bay Sediments Collected July 18-20, 2001 (Page 2 of 2)

Sample	Replicate	Number of Survivors[a]
E-KB01-4	A	20
	B	18
	C	17
	D	16
	E	15
	Total	86
	Percent	86%
E-KB01-5	A	18
	B	20
	C	19
	D	19
	E	18
	Total	94
	Percent	94%
E-KB01-2 DUP	A	16
	B	14
	C	17
	D	16
	E	16
	Total	79
	Percent	79%
RS-KB01	A	18
	B	19
	C	19
	D	18
	E	20
	Total	96
	Percent	96%

a - Based upon 100 organisms exposed

Table 22. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Mysidopsis bahia* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 1 of 2)

Mysidopsis bahia Control Sediment vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	7	35.6	5.0857	3.0138
Within Means	32	54.0	1.6875	
Total	39	89.6		

Critical F = 2.31 ($\alpha = 0.05$, df = 7,32)
Since F is > Critical F reject H_o: all groups equal;
with $\alpha = 0.05$, and 7,32 df.

Dunnett's Test

Critical T = 2.45

Sample ID	$\alpha = 0.05$	difference between means	T Stat
Control Sediment	–	–	–
E-KB01-1	=	0.8	0.97
E-KB01-2	=	1.0	1.22
E-KB01-3	=	0.0	0.00
E-KB01-4	=	0.8	0.97
E-KB01-5	=	-0.8	-0.97
E-KB01-2-DUP	*	2.2	2.68
Reference Sediment RS-KB01	=	-0.8	-0.97

= Indicates no significant difference between the sample station and the control sediment
* Indicates a significant difference exists between the sample station and the control sediment

Table 22. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Mysidopsis bahia* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 2 of 2)

Mysidopsis bahia Reference Sediment vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	6	34.6857	5.7810	3.1128
Within Means	28	52.00	1.8571	
Total	34	86.6857		

Critical F = 2.45 ($\alpha = 0.05$, df = 6,28)
Since F is > Critical F reject H_o: all groups equal;
with $\alpha = 0.05$, and 6,28 df.

Dunnett's Test

Critical T = 2.43

Sample ID	$\alpha = 0.05$	difference between means	T Stat
Reference Sediment RS-KB01	–	–	–
E-KB01-1	=	1.6	1.86
E-KB01-2	=	1.8	2.09
E-KB01-3	=	0.8	0.93
E-KB01-4	=	1.6	1.86
E-KB01-5	=	0.0	0.00
E-KB01-2-DUP	*	3.0	3.48

= Indicates no significant difference between the sample station and the reference sediment
* Indicates a significant difference exists between the sample station and the reference sediment

Table 23. 10- Day Sediment *Leptocheirus plumulosus* Survival, Kings Bay Sediments Collected July 18-20, 2001 (Page 1 of 2)

Sample	Replicate	Number of Survivors[a]	
		Initial Run	Ammonia Purge Re-Run
CONTROL SEDIMENT	A	18	19
	B	20	17
	C	20	19
	D	20	18
	E	18	18
	Total	94	91
	Percent	94%	91%
E-KB01-1	A	14	NR
	B	12	
	C	10	
	D	8	
	E	15	
	Total	59	
	Percent	59%	
E-KB01-2	A	16	19
	B	18	17
	C	14	18
	D	13	17
	E	15	17
	Total	76	88
	Percent	76%	88%
E-KB01-3	A	16	18
	B	14	19
	C	14	20
	D	15	19
	E	15	18
	Total	74	94
	Percent	74%	94%

Table 23. 10- Day Sediment *Leptocheirus plumulosus* Survival, Kings Bay Sediments Collected July 18-20, 2001 (Page 2 of 2)

Sample	Replicate	Number of Survivors[a]	
		Initial Run	Ammonia Purge Re-Run
E-KB01-4	A	18	NR
	B	19	
	C	18	
	D	18	
	E	19	
	Total	92	
	Percent	92%	
E-KB01-5	A	20	NR
	B	20	
	C	20	
	D	19	
	E	19	
	Total	98	
	Percent	98%	
E-KB01-2 DUP	A	19	18
	B	15	19
	C	15	20
	D	16	19
	E	14	19
	Total	79	95
	Percent	79%	95%
RS-KB01	A	18	18
	B	20	20
	C	20	17
	D	20	19
	E	20	18
	Total	98	92
	Percent	98%	92%

a - Based upon 100 organisms exposed

Table 24. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Leptocheirus plumulosus* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 1 of 5)

INITIAL RUN

Leptocheirus plumulosus Control Sediment vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	7	282.8	40.4000	17.1005
Within Means	32	75.6	2.3625	
Total	39	358.4		

Critical F = 2.31 ($\alpha = 0.05$, df = 7,32)
Since F is > Critical F reject H_o: all groups equal;
with $\alpha = 0.05$, and 7,32 df.

Dunnett's Test

Critical T = 2.45

Sample ID	$\alpha = 0.05$	difference between means	T Stat
Control Sediment	–	–	–
E-KB01-1	*	7.4	7.61
E-KB01-2	*	4.0	4.11
E-KB01-3	*	4.4	4.53
E-KB01-4	=	0.8	0.82
E-KB01-5	=	-0.4	-0.41
E-KB01-2-DUP	*	3.4	3.50
Reference Sediment RS-KB01	=	-0.4	-0.41

= Indicates no significant difference between the sample station and the control sediment
* Indicates a significant difference exists between the sample station and the control sediment

Table 24. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Leptocheirus plumulosus* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 2 of 5)

INITIAL RUN

Leptocheirus plumulosus Reference Sediment vs. Other Samples

Steel's Many-One Rank Test

Sample ID	$\alpha = 0.05$	Mean in original units	Rank Sum	Critical+ Value
Reference Sediment RS-KB01	–	19.6	–	
E-KB01-1	*	11.8	15.0	16.0
E-KB01-2	*	15.2	15.5	16.0
E-KB01-3	*	14.8	15.0	16.0
E-KB01-4	=	18.4	18.5	16.0
E-KB01-5	=	19.6	26.0	16.0
E-KB01-2-DUP	*	15.8	16.0	16.0

= Indicates no significant difference between the sample station and the reference sediment
* Indicates a significant difference exists between the sample station and the reference sediment
+ Critical values are 1 tailed (k=6)
Degree of Freedom = 5.00

Table 24. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Leptocheirus plumulosus* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 3 of 5)

AMMONIA PURGE RE-RUN

Leptocheirus plumulosus Control Sediment vs. Other Samples

ANOVA for Differences Between Means

Source of Variation	df	Sum of Squares	Mean Square	F
Between Means	4	6.0000	1.5000	1.8750
Within Means	20	16.0000	0.8000	
Total	24	22.0000		

Critical F = 4.4307 ($\alpha = 0.015$, df = 4,20)
Since F is < Critical F Fail to reject H_o: all groups equal;
with $\alpha = 0.05$

Dunnett's Test

Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	control	18.2000	18.2000		
2	KB01-02	17.6000	17.6000	1.0607	
3	KB01-02 DUP	19.0000	19.0000	-1.4142	
4	KB01-03	18.8000	18.8000	-1.0607	
5	RS-KB01	18.4000	18.4000	-0.3536	

Dunnett critical value = 2.3000 (1 Tailed, alpha = 0.05, df = 4,20)

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	control	5			
2	KB01-02	5	1.3011	7.1	0.6000
3	KB01-02 DUP	5	1.3011	7.1	-0.8000
4	KB01-03	5	1.3011	7.1	-0.6000
5	RS-KB01	5	1.3011	7.1	-0.2000

Table 24. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Leptocheirus plumulosus* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 4 of 5)

AMMONIA PURGE RE-RUN

Leptocheirus plumulosus Control Sediment vs. Other Samples

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	RS-KB01	5	17.0000	20.0000	18.4000
2	KB01-02	5	17.0000	19.0000	17.6000
3	KB01-02DUP	5	18.0000	20.0000	19.0000
4	KB01-03	5	18.0000	20.0000	18.8000

Summary Statistics on Data

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	RS-KB01	1.3000	1.1402	0.5099	6.1966
2	KB01-02	0.8000	0.8944	0.4000	5.0820
3	KB01-02DUP	0.5000	0.7071	0.3162	3.7216
4	KB01-03	0.7000	0.8367	0.3742	4.4503

ANOVA

SOURCE	DF	SS	MS	F
Between	3	5.7500	1.9167	2.3232
Within (Error)	16	13.2000	0.8250	
Total	19	18.9500		

(p-value = 0.1138)

Critical F = 5.2922 (alpha = 0.01, df = 3,16)
= 3.2389 (alpha = 0.05, df = 3,16)
Since F < Critical F FAIL TO REJECT Ho: All equal (alpha = 0.05)

Table 24. Summary of ANOVA and Dunnett's Tests for Sediment Bioassays of *Leptocheirus plumulosus* Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 5 of 5)

AMMONIA PURGE RE-RUN

Dunnett's Test — Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	T STAT	SIG 0.05
1	RS-KB01	18.4000	18.4000		
2	KB01-02	17.6000	17.6000	1.3926	
3	KB01-02 DUP	19.0000	19.0000	-1.0445	
4	KB01-03	18.8000	18.8000	-0.6963	

Dunnett critical value = 2.2300 (1 Tailed, alpha = 0.05, df = 3,16)

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	RS-KB01	5			
2	KB01-02	5	1.2810	7.0	0.8000
3	KB01-02 DUP	5	1.2810	7.0	-0.6000
4	KB01-03	5	1.2810	7.0	-0.4000

= Indicates no significant difference between the sample station and the reference sediment
* Indicates a significant difference exists between the sample station and the reference sediment
+ Critical values are 1 tailed (k=6)
Degree of Freedom = 5.00

3.5 Bioaccumulation Data

The bioaccumulation test conditions, including temperature, DO, pH, and salinity, were maintained at acceptable levels throughout the 28-day testing period. The laboratory raw data are provided in Appendices A-9 and A-10.

Macoma nasuta

Data for the survival of *M. nasuta* in the bioaccumulation tests are presented in Table 25. *M. nasuta* survivorship in the laboratory control sediment was 84% . Survival of *M. nasuta* in the site sediments ranged from 69% (sample station E-KB01-4) to 85% (sample station E-KB01-2) (Table 25). Adequate mass of *M. nasuta* tissue was available for chemical analyses for all of the samples, if required.

Nereis virens

Data for the survival of *N. virens* in the bioaccumulation tests are also presented in Table 25. *N. virens* survivorship in the laboratory control sediment was 99%. Survival of *N. virens* in the site sediments ranged from 88% (sample station E-KB01-1) to 99% (sample station E-KB01-3, E-KB01-4, E-KB01-5, E-KB01-2 DUP, and RS-KB01) (Table 25). Adequate mass of *N. virens* tissue was available for chemical analyses for all samples, if required.

3.5.1 Metals Bioaccumulation Data

Metals results for *M. nasuta* and *N. virens* are presented in Table 26 and Table 27, respectively. Statistical analyses were performed on the metal bioaccumulation data and may be found at the end of Appendix C with the quality control tables.

Macoma nasuta

Mercury was not detected in any of the samples. Arsenic, cadmium, chromium, copper, lead, nickel, and silver were either below detection or found at low concentrations. Zinc was found at higher levels (approximately 9-14 mg/kg, wet weight basis).

Nereis virens

Lead and mercury were below detectable levels. Arsenic, cadmium, chromium, copper, nickel, and silver were either below detection of found at low levels. Zinc was present in all samples at approximately 7-46 mg/kg, wet weight basis.

3.5.2 Bioaccumulation Data Summary

The data show that levels of arsenic, cadmium, chromium, copper, lead, mercury, nickel, and silver in the sample organisms are not significantly higher than in the control organisms or the reference site organisms. Zinc does show some samples that are significantly higher. However, there are no Food and Drug Administration (FDA) action levels for these metals.

Table 25. Survivorship of *Macoma nasuta* and *Nereis virens* During 28-Day Bioaccumulation Bioassays Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 1 of 2)

Sample ID	Replicate[a]	*Macoma nasuta*	*Nereis virens*
Control Sediment	A	15	20
	B	20	20
	C	20	19
	D	18	20
	E	11	20
	Total[b]	84	99
Station E-KB01-1	A	16	16
	B	15	20
	C	19	14
	D	13	18
	E	19	20
	Total[b]	82	88
Station E-KB01-2	A	15	20
	B	16	19
	C	19	19
	D	18	19
	E	19	20
	Total[b]	85	97
Station E-KB01-3	A	17	20
	B	13	20
	C	15	20
	D	18	19
	E	17	20
	Total[b]	80	99

Table 25. Survivorship of *Macoma nasuta* and *Nereis virens* During 28-Day Bioaccumulation Bioassays Conducted on Kings Bay Sediments Collected July 18-20, 2001 (Page 2 of 2)

Sample ID	Replicate[a]	*Macoma nasuta*	*Nereis virens*
Station E-KB01-4	A	16	20
	B	14	19
	C	15	20
	D	12	20
	E	12	20
	Total[b]	69	99
Station E-KB01-5	A	13	20
	B	17	20
	C	12	19
	D	16	20
	E	14	20
	Total[b]	72	99
Station E-KB01-2 DUP	A	16	19
	B	19	20
	C	16	20
	D	17	20
	E	15	20
	Total[b]	83	99
Station RS-KB01	A	16	20
	B	16	20
	C	14	20
	D	13	19
	E	11	20
	Total[b]	70	99

[a] One hundred organisms exposed per sample

[b] Totals represent number alive and percent survival

Table 26. Results of Metals Analyses in *Macoma nasuta* Tissues for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in mg/kg and presented on dry and wet weight basis] (Page 1 of 2)

Station ID	PPB #	% Solids	Arsenic		Cadmium		Chromium		Copper		Lead	
			Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Control Sediment	214633	9.0	3.0	32.8	0.1	0.3	0.07	0.8	2.5	27.8	0.1	1.1
RS-KB01	214634	10.1	3.1	30.8	0.1	0.3	0.05	0.5	1.9	18.4	<0.1	<0.9
E-KB01-1	214635	9.1	2.8	31.0	0.1	0.3	0.06	0.7	2.3	24.8	0.1	1.0
E-KB01-2	214636	8.2	2.7	32.7	0.1	0.3	0.06	0.7	1.9	22.8	<0.1	<1.1
E-KB01-2 DUP	214637	10.5	3.2	30.3	0.1	0.2	0.11	1.0	3.3	31.0	0.1	1.3
E-KB01-3	214638	11.8	3.0	25.8	0.1	0.3	0.11	0.9	3.6	30.8	0.1	0.9
E-KB01-4	214639	12.3	3.4	27.8	0.1	0.3	0.11	0.9	4.4	35.9	0.2	1.4
E-KB01-5	214640	9.2	2.8	30.5	0.1	0.3	0.09	1.0	3.0	32.6	0.1	1.6

Table 26. Results of Metals Analyses in *Macoma nasuta* Tissues for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in mg/kg and presented on dry and wet weight basis] (Page 2 of 2)

Station ID	PPB #	Mercury		Nickel		Silver		Zinc	
		Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Control Sediment	214633	<0.1	<0.20	0.2	2.1	0.042	0.462	12.2	135
RS-KB01	214634	<0.1	<0.20	0.2	2.0	0.030	0.296	11.2	111
E-KB01-1	214635	<0.1	<0.21	0.2	2.1	0.048	0.526	12.0	132
E-KB01-2	214636	<0.1	<0.20	0.2	2.9	0.039	0.472	9.2	112
E-KB01-2 DUP	214637	<0.1	<0.20	0.2	2.1	0.072	0.683	11.1	106
E-KB01-3	214638	<0.1	<0.20	0.2	1.7	0.100	0.849	12.2	103
E-KB01-4	214639	<0.1	<0.20	0.2	1.9	0.110	0.893	14.1	115
E-KB01-5	214640	<0.1	<0.20	0.2	2.6	0.074	0.804	10.1	110

Table 27. Results of Metals Analyses in *Nereis virens* Tissues for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in mg/kg and presented on dry and wet weight basis] (Page 1 of 2)

Station ID	PPB #	% Solids	Arsenic		Cadmium		Chromium		Copper		Lead	
			Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Control Sediment	214641	9.8	2.7	27.8	0.1	0.4	0.06	0.6	1.3	13.2	<0.1	<0.9
RS-KB01	214642	11.3	2.6	23.1	0.1	0.5	0.08	0.7	1.2	10.3	<0.1	<0.8
E-KB01-1	214643	10.4	2.8	27.1	0.1	0.5	0.06	0.6	1.4	13.6	<0.1	<0.9
E-KB01-2	214644	10.0	2.3	23.3	0.1	0.4	0.06	0.6	1.1	10.8	<0.1	<1.0
E-KB01-2 DUP	214645	10.5	2.7	25.6	0.1	0.4	0.06	0.6	1.2	11.0	<0.1	<0.9
E-KB01-3	214646	10.0	2.3	22.9	0.1	0.4	0.07	0.7	1.1	11.0	<0.1	<0.9
E-KB01-4	214647	10.6	2.7	25.0	0.1	0.4	0.07	0.7	1.3	11.9	<0.1	<0.8
E-KB01-5	214648	10.2	2.9	28.8	0.1	0.4	0.08	0.8	1.4	13.9	<0.1	<0.9

Table 27. Results of Metals Analyses in *Nereis virens* Tissues for Sediments Collected at Kings Bay on July 18-20, 2001 [all data reported in mg/kg and presented on dry and wet weight basis] (Page 2 of 2)

Station ID	PPB #	Mercury		Nickel		Silver		Zinc	
		Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Control Sediment	214633	<0.1	<0.20	0.1	1.3	0.014	0.147	8.4	85.6
RS-KB01	214634	<0.1	<0.20	0.1	1.1	0.013	0.114	14.9	132
E-KB01-1	214635	<0.1	<0.20	0.1	1.2	0.016	0.154	19.3	186
E-KB01-2	214636	<0.1	<0.20	0.1	1.2	0.012	0.123	12.6	126
E-KB01-2 DUP	214637	<0.1	<0.20	0.1	1.3	0.011	0.107	7.7	72.9
E-KB01-3	214638	<0.1	<0.20	0.1	1.2	0.014	0.140	22.0	220
E-KB01-4	214639	<0.1	<0.20	0.1	1.4	0.013	0.127	45.9	433
E-KB01-5	214640	<0.1	<0.20	0.2	1.5	0.011	0.111	24.4	239

3.6 Quality Assurance

Sampling and analysis of Kings Bay water and sediment samples was performed to characterize sediment quality with regard to dredged material proposed for ocean disposal.

Sediment samples were collected for chemical, physical, and bioassay testing at Harbor Branch Environmental Laboratory (HBEL), Harding ESE, Law Engineering, and PPB Environmental Laboratories, Inc. Relevant observations and in situ measurements were made at the harbor area and at the reference sites, i.e., at two locations near the Kings Bay Ocean Dredged Material Disposal Site (ODMDS). All samples were sent from the field team to PPB for processing and distribution to subcontractor laboratories.

Project objectives and goals were delineated during a project initiation meeting held on June 10, 2001 in Gainesville, Florida. Lines of communication were established and project tasks and responsibilities were assigned. A schedule was developed and discussed with team members to confirm task and milestone assignment and scheduling. A scope of work was distributed to team members. All field measurements and observations were made during the July 18-20, 2001 sample collection effort. All water and sediment samples were transported to PPB by commercial carrier. After sample log-in and processing at PPB, samples were distributed to project team member organizations for chemical, physical, and biological testing.

The quality control data discussed in this section appear in Appendix C.

QA: Sediments

Metals data for the sediment samples showed matrix spike recoveries of 42% to 103%. Reference standard accuracy values generally fell between 90% and 111% recovery. Precision data for metals in sediment samples were less than 15% RSD.

Cyanide data had matrix spike accuracy values of 102%. Reference recoveries were 96%. Ammonia data had a matrix spike accuracy value of 104% and reference recoveries of 113%.

TOC data for sediments showed clean method blanks and matrix spike/matrix spike duplicates were 95%. The reference standard recovery was 99%. Pesticide/PCB data for sediments showed reference standard recoveries that met all acceptance criteria.

For PAHs, some surrogates exceeded acceptance criteria. These surrogates were above acceptance criteria. This being the case, any target compounds affected would have exhibited a high bias. The fact that these samples were non-detect for PAHs precludes any impact to the data quality objectives (DQOs) for the associated samples.

Due to the sample matrix, Tributyltin did not meet acceptable precision criteria in the MS/MSD. (%RSD 80 with a control limit of 30). However, the associated Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/ LCSD) met all acceptance criteria which would strongly imply that the precision criteria was exceeded due to sample matrix.

QA: Elutriates

Metals data for elutriates showed matrix spike recoveries of 76% to 98%. Recoveries for standard reference materials ranged from 96% to 108%. Precision data were good, with %RSD for sample pairs falling between 0% and 10%.

Organic analyses of elutriates for pesticides, PCBs, and PAHs yielded no detectable results for any of the samples. All precision and accuracy data for pesticides and PCBs met acceptance criteria. The percent recoveries, in general, ranged from 62% to 119% recovery and within the precision acceptance criteria of 30% RSD.

For PAH analyses of elutriates, QC acceptance criteria were not met for target analytes with the exception of 2-methylnaphthalene and 1-methylnaphthalene. However, criteria were met for QC associated with the sediment samples. In addition, no PAH target analytes were found in the sediment samples. Due to the "aggressive" nature of the solvent used for the extraction of sediments and because QC criteria were met, the samples would have exhibited "positives" for PAHs had they been present. Since none were found in the sediment and all QC criteria were met for the sediments, it is believed that no measurable PAHs could have been present in the elutriates.

QA: Tissues

Metals data for tissues showed matrix spike recoveries of 83% to 123%. Recoveries for standard reference materials ranged from 75% to 112%. Precision data were good, with %RSD sample pairs falling between 0% and 28.7%.

4

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4.0 REFERENCES

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